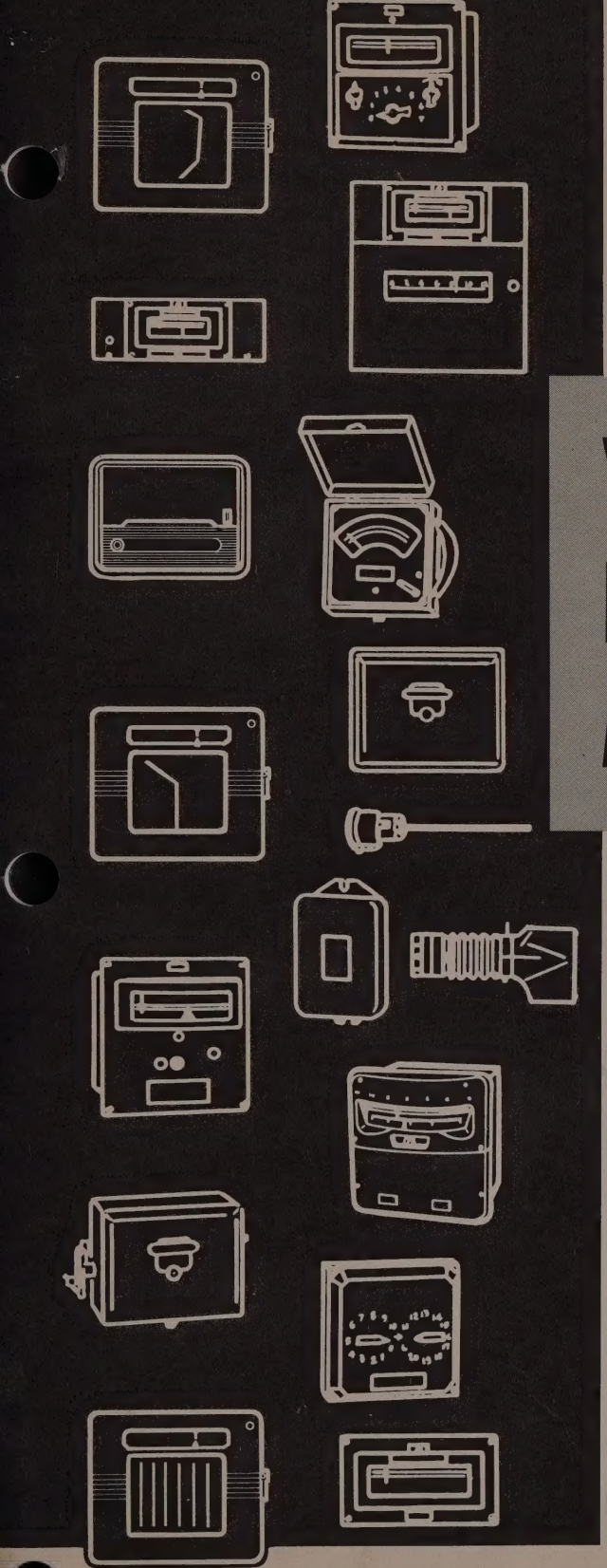

2000 SERIES INDICATOR
RECORDER-CONTROLLER

WHEELCO INSTRUCTION MANUAL

MP MASTER
MA32112

BARBER COLMAN

BARBER-COLMAN COMPANY

Wheelco Instrument Division | ROCKFORD, ILLINOIS, U. S. A.

GENERAL OPERATING INSTRUCTIONS

INTRODUCTION

This instruction manual has been designed to help you secure maximum operational benefits from the installation of your new 2000 Series Wheelco Indicator-Recorder-Controller. Your Wheelco factory trained field engineer is always available for further help in the solution of your industrial control problems. Offices are located in all principal cities.

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SPECIFICATIONS - SERIES 2000

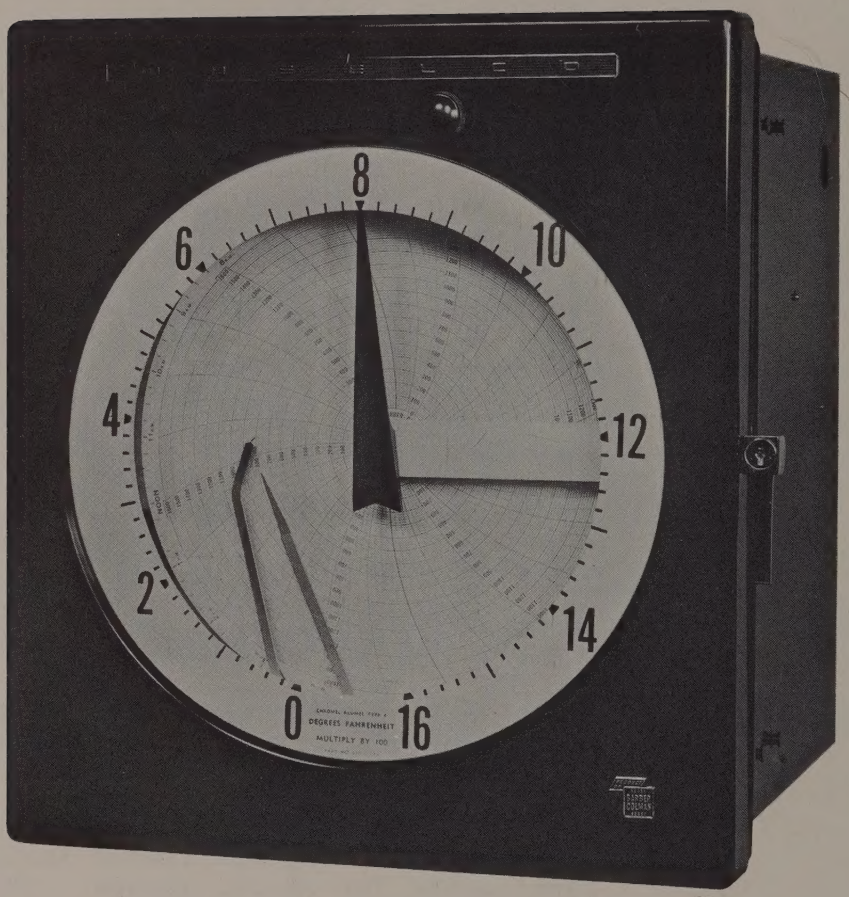
Indicating Scale	32" calibrated length. Illuminated when specified.
Chart	12" diameter, 4-5/8" calibration.
Pen Speed	2, 4 and 20 seconds. Other speeds available
Current Standardizer	Constant voltage standard, manual optional.
Sensitivity	Sensitive to change of 5 microvolts for span of 5 millivolts or less - 1/10 of 1% for scale spans wider than 5 millivolts.
Scale Range	Available in full selection of standard scale ranges.
Housing	Case: Dust proof. Steel construction with baked enamel finish. Door: High impact thermosetting plastic.
Weight	Approximately 60 pounds.
Electronic Failsafe	Standard with all instruments, unless specified otherwise.
Accuracy	1/4 of 1% full scale range.
Control Switches	Adjustable over 100% of full scale range.
Control Contact Rating	10 amp 110-115 V. 5 amp 230 V. Non-inductive loads
Power Rating	58 watts with chart motor and balance motor stalled. 55 watts with normal operation (motors running). NOTE: These ratings include fluorescent lamp. Maximum wattage listed includes chart motor for faster speeds. (Requires a larger motor.)

SUMMARY DESCRIPTION OF THE 2000 SERIES ELECTRONIC CIRCUIT

The series 2000 Recorder-Indicator is a continuous null balance type d-c potentiometer. This electronic null balancing action is accomplished in the following manner.

The primary element senses an emf. This small d-c voltage generated by the thermocouple (pH., Mv., etc.) is measured and compared to the voltage output of a constant voltage source.

The measuring circuit consists of an adjustable precision calibrated emf which is connected to oppose the emf being measured. If there is a difference in the two voltages, an


8
6
10
4
12
2
14
0
16
DEGREES FAHRENHEIT
MULTIPLY BY 100

unbalanced condition will exist. This d-c unbalance is converted to an a-c signal and amplified through the high gain amplifier.

The output of the amplifier is applied to a two phase balance motor which adjusts the position of the variable contact on the slidewire, increasing or decreasing the measuring circuit voltage to bring circuitry to an electronic null balance.

When used as a controller, the overall circuitry always strives to obtain a balance condition at the control point.

When a null balance is achieved, there are no moving parts, hence a minimum of wear on all parts is accomplished.

The failsafe circuit used is standard with all recorders. This is a safety feature to protect equipment being controlled against failure of component parts in the amplifier circuits plus failure of the sensing unit and components in the measuring circuits.

This failsafe action is accomplished by introducing an a-c voltage to the grid of the 4th stage of voltage amplification. This voltage is sufficient to drive the motor upscale past the control point to shut down the controlled equipment.

The failsafe is supplied with upscale drive unless specified otherwise. The failsafe may be eliminated for special applications.

UNPACKING INSTRUCTIONS

This precision instrument has been carefully manufactured and packed at the factory. Remove the instrument and accessories from the packing box and check items against the packing slip. If the equipment is found to be damaged in transit, report extent of damage to the carrier immediately. Repack in original packing box until ready for installation. Any instructions given on tags attached to the instrument should be followed carefully and then tags removed.

CAUTION:

Handle with care.

Safeguard instrument from shock.

The instrument should not be installed in locations where the ambient temperature exceeds 130°F.

Avoid dust or oil accumulations.

Install instrument away from external or stray electrical interference.

The instrument case should be grounded (unless otherwise specified).

L1 should be connected to the "hot" side of the line terminals.

L2 should be connected to the grounded side of the line terminals.

When using an insulated panel, connection should be made to a grounded bus bar.

MOUNTING INSTRUCTIONS

Locate the instrument to avoid shock, excessive vibration and moisture.

Avoid furnace walls, radiation of heat machine frames and outside walls. Provide suitable shelter to avoid moisture and temperature extremes if installed outdoors.

Special provisions may have to be considered if the instrument is subjected to severe shock such as a drop forge or similar type of equipment.

POWER WIRING

Check the rating plate on the side of chassis for the supply voltage and frequency.

Connect proper voltage and frequency to terminals L1 and L2. Supply voltage should be 105 to 125 VAC. Voltages other than standard should have an additional transformer and should be specified on the order for the instrument. Run all wiring in rigid conduit, BX or Greenfield, in accordance with the recommended electrical code. Use properly fused switches; see diagram.

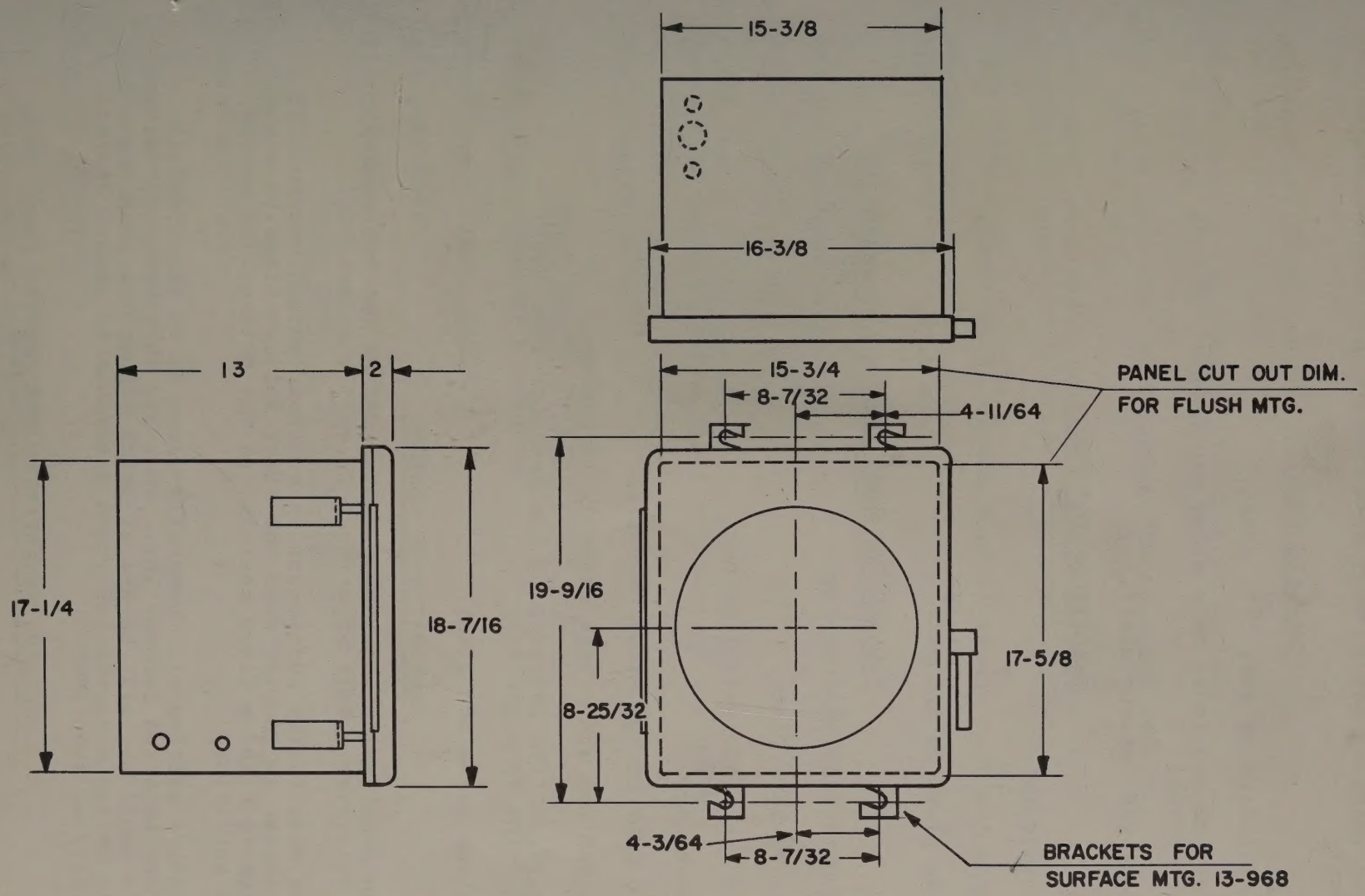
The instrument terminals are constructed to insert the wire in the terminal and tighten the binding screw to secure the wire permanently. Solid wire (14 ga.) is recommended for instrument wiring. If stranded wire is used, tin the ends to provide secure connections. Position the wires so that they do not interfere with control chassis or the housing gaskets.

THERMOCOUPLE WIRING

Do not run thermocouple leadwire with other power or control wiring. The internal wiring is designated with the low voltage wires run to the top of the inside of the case and the high voltage wire along the bottom of the inside of the case. Several thermocouple leadwires may be run in the same conduit.

Proper polarity (+) and (-) and the correct type of leadwire must be observed to obtain the correct reading. The negative wire is always coded red. Correct polarity of the leadwire can be checked by heating a temporary junction of the leadwire far end. Upscale drive of the instrument indicates the correct polarity.

The thermocouple should then be connected to the leadwire and the indicating pointer should again drive upscale when the thermocouple hot junction is heated. If the indicator moves downscale, reverse only the connection at the thermocouple head



MOUNTING DIMENSIONS

since the leadwire has already been correctly connected to the instrument.

CHANGING CHART

1. Swing Indicator away from chart.
2. Latch pen and index onto stops provided at left of chart frame.
3. Remove and replace chart.

REMOVING CHART PLATE

1. Remove chart.
2. Loosen the four screws in each corner of the plate.
3. Slide plate up and off.

FILLING PEN RESERVOIR

1. USE ONLY PART #56-010 INK
2. Remove chart plate.
3. Slip reservoir out of holder.
4. Remove cap.
5. FILL ONLY TO TOP RIDGE ON BOTTLE.
6. Replace cap and return assembly to bracket.
7. Apply positive pressure to the breather tube until ink drips from pen tip.
8. Replace plate and chart.

SENSITIVITY CONTROL

The sensitivity adjustment is located on the top center of the amplifier. This adjustment is easily accessible.

The sensitivity adjustment is a linear potentiometer. This potentiometer is coupled from the first voltage stage by means of a capacitor and a fixed resistor to the grid of the second voltage amplifier.

Factory setting will generally prove to be satisfactory until tube emission becomes low. When the tube emission becomes low, the amplifier will become sluggish. When the gain control is fully CW and sluggish condition continues to exist, replace tubes 12AX7 or tube 5763.

CHECKING SENSITIVITY CONTROL

1. Swing chart frame out.

2. Adjust sensitivity control CW until balance motor starts to oscillate.

3. Rotate sensitivity control CCW until motor stops oscillating.

4. Adjust sensitivity control CW until motor torque is greatest without motor oscillation.

5. Turn metal gear (1st step) CW or CCW to check recovery of pen on chart.

6. Turn metal gear (with finger) upscale and allow motor to restore slowly to balance. Note position.

7. Turn metal gear downscale as in (5).

8. The difference between the two positions should be less than 1/10 of 1% of full scale.

OIL BALANCING MOTOR (EVERY MONTH)

1. Use oil furnished with recorder.

2. Remove chart plate.

3. Place one or two drops of oil in each of the two oil reservoirs located at the front and back on the top of the motor.

4. Remove excess oil.

OTHER OILING POINTS (EVERY MONTH)

1. Use oil furnished with recorder.

2. Every shaft with a pulley.

3. All gear teeth.

4. All bearing surfaces for shafts, etc.

QUICK CHECK LIST OF TROUBLES

Blown Fuses

A. Instrument fuse.

1. Lamp Circuit
2. Chart Drive Motor
3. Amplifier and Balance Motor

Pointerdrive Upscale

1. Open input element (T/C)
2. Gain control too far (CCW)
3. Standardizer leaf switch, Contact No. 2 Open (if C.V.S. is not being used)

4. Defective V1-12AX7 (1st and 2nd Voltage Stage)
5. Defective V2-12AX7 (3rd Stage, 1st Section)
6. Open range spool, change bracket
7. Rheostat contacts open circuited (if C.V.S. is not being used)
8. Slidewire contacts open circuited
9. Dirty slidewire

Pointerdrive Downscale

1. Reversal of T/C leads
2. Reversal of motor
3. Reversal of Chopper leads
4. Short circuited T/C

Sluggish Operation

1. Low Amplification
   a. Defective tube
   b. Amplifier noise
2. Phasing capacitors defective
3. Motor
4. Gear Train
5. Stray external signals
6. Noise filter omitted (2 mfd on T/C circuit)

Balance Motor Fails to Operate

1. Input circuit open (no failsafe)
2. Amplifier defective
3. Measuring circuit open
   (with failsafe, should drive upscale)
4. Motor defective
5. Phasing capacitors defective
6. Stray external signals

Chart Motor Fails to Operate

1. Excessive load
2. Defective motor
3. Defective phasing capacitor
4. Motor shaft and gear binding

Fails to Standardize (if constant voltage source not used)

1. Balancing motor off
2. Switch not making contact
3. Open in balance circuit
4. Rheostat failing
5. Battery dead
6. Loose connections

Reads Ambient, Will Not Respond To Change In Input Signal

1. Shorted T/C
2. Shorted measuring circuit capacitors

Balance Motor Operates But Pen Fails To Drive Upscale or Downscale

1. Friction clutch slipping on main shaft.
2. Broken gear.
3. Screw on pen is loose.

Chart Motor Operates But Chart Fails to Move

1. Broken cable.
2. Stripped gears either in chart drive assembly or loose main chart drive assembly.

MAINTENANCE TIPS

These recorders are calibrated at the factory to an accuracy of 1/4 of 1% of full scale or better. This accuracy is to be expected, with no further checks, unless the instrument is damaged in shipment. If accuracy of calibration is questioned, the following procedure should be used, providing the range of the instrument is such as to include normal ambient temperatures.

1) Standardize instrument. (if c.v.s., not used)

2) Place mercury thermometer inside case (near cold junction).

3) Short TC- to TC+. Temperature indicator should read case temperature (ambient).

4) If the pen does not read correct temperature, adjust the set screw in the micro-adjust block that holds the pen to the shaft. If this will not give enough correction, loosen large screw on this block and rotate entire pen assembly on the shaft.

5) Ample time should be taken, with door closed and instrument running normally, to enable the cold junction spool to become saturated with case temperature. Drafts or opening of case door may cause errors during checking.

NOTE: a) Mercury thermometer will respond to change in temperature more quickly than the cold junction spool.

b) Instrument has approximately a 30°F. heat rise during normal operating conditions.

If instrument has a suppressed range, ambient temperature check cannot be made as described in preceding paragraphs. Instrument should then be checked with Wheelco Portable Potentiometer Model 330 or equivalent.

Checking Accuracy of Instrument with Wheelco Model 330

1) Use procedure described in Instruction Sheet 5370A, Wheelco Portable Potentiometer Operating and Service Instructions, page 15, section 16.

If instrument is found to be in error, correction can usually be made by adjusting the:

1) Pen position. This can be done by following procedure #4 above.

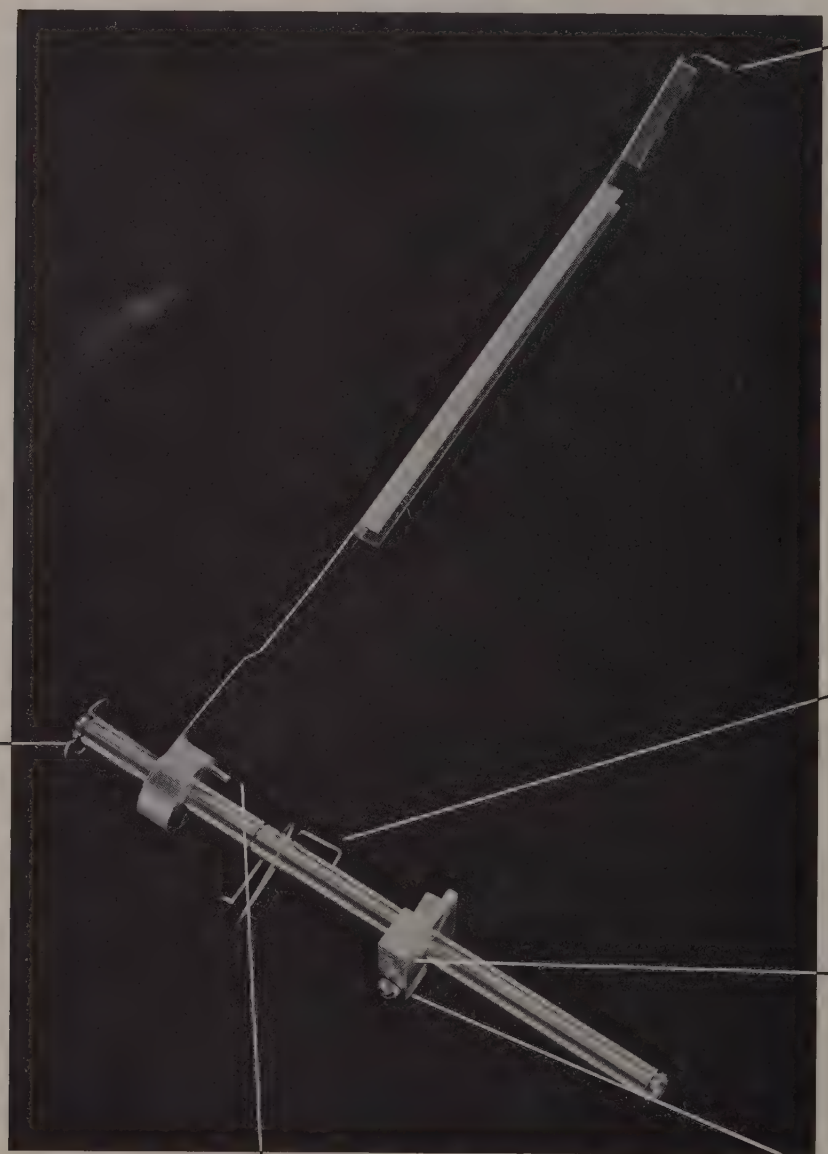
2) Slidewire. If reading is high on one end of the scale and low at the opposite end of the scale:

   a) Reposition slidewire for low end adjustments, loosen three holding screws and shift complete slidewire assembly to desired reading.

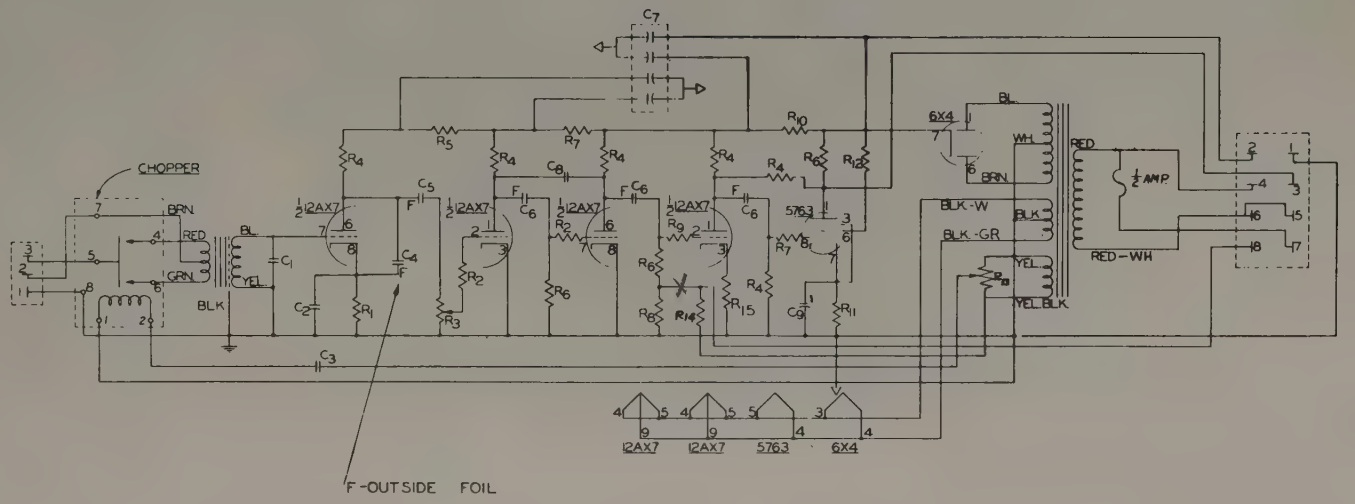
   b) Adjust span (vernier) for high end errors, loosen screw and move slider to the right if reading is high. If reading is low, move slidewire to the left. This adjustment is a factory function and should be done only by a qualified instrument man.

NOTE: It is important that the span screw be secured firmly to insure a clean contact. Sealing wax or paint should be applied to this screw after calibration is completed.

PEN ASSEMBLY
EXPLODED



AMPLIFIER WIRING SCHEMATIC



			R_{15}	1K ±10	½W	CYZR 171-23
			R_{14}	4.7K ±10%	½W	40-008-3
			R_{13}	150	±10% 10W	CYZR 15
			R_{12}	15Ω	±10% 10W	40-093
			R_{11}	750Ω	±10% 5W	40-100
			R_{10}	100K	±10% 1W	CYZR 171-3
C_9	50 MFD 50 WVDC	CYZR 156	R_9	2.7 MEG	±10% ½W	40-003-1
C_8	250 MMF 500 WVDC ±20%	39-076	R_8	47K	±10% ½W	40-070-1
C_7	20-20-20-20 MFD 450 WVDC	39-091	R_7	100K	±10% ½W	40-019-1
C_6	05 MFD 600 WVDC	39-041-2	R_6	1.0 MEG	±10% ½W	CYZR 170-41
C_5	02 MFD 600 WVDC ±10%	39-025-2	R_5	150K	±10% ½W	40-049
C_4	015 MFD 600 WVDC ±10%	39-050-1	R_4	470K	±10% ½W	CYZR 170-13
C_3	2.0 MFD 200 WVDC ±20%	39-077	R_3	0-2 MEG	VARIABLE	29-051
C_2	100 MFD 12 WVDC	39-092	R_2	220K	±10% ½W	CYZR 170-43
C_1	05 MFD 400 WVDC	CYZR 173-3	R_1	4.7K	±10% ½W	40-008-3
	DESCRIPTION	PART NO		DESCRIPTION		PART NO.

CONSTANT VOLTAGE SUPPLY (CVS)

The constant voltage source eliminates standardization of the instrument. Of course, with the elimination of the standardization there is no need for the #6 dry cell and the standard cell or the mechanical standardizer.

From a maintenance view the elimination of the gearing and levers associated with the standardizer should minimize the maintenance troubles encountered in all mechanical type standardizers.

From an accuracy standpoint the performance will be as good as or better than the mechanical standardizer. This is evident from the fact that the constant voltage source is constantly self-checking whereas the mechanical type standardizer operates only every 40 minutes. Adjustments of the standardizing switch will be eliminated. A 5 second period is required to compare the standard cell with the battery supply voltage in the standard cell type instrument. It is apparent while this standardizing cycle is in progress a change in the control temperature or variable is not indicated until this cycle is completed. If load changes are large, the effect will be more evident on the faster cross chart speeds, hence, the larger the change the greater the deviation from the control point. It is well to note that while the mechanical standardizing method is satisfactory for present day applications, the industry is striving for closer control and uninterrupted recordings and control of processes.

Description and Theory of Constant Voltage Source

The reference voltage source consists primarily of a 117 volt isolation transformer, a rectifier and filtering network, 3 silicon diodes and further dropping resistors to effect an output of 1.019 volts DC for the measuring circuits of the Potentiometer. The silicon diodes are used for the reference voltage in the potentiometer to replace the standard cell in the standardizing mechanism.

The silicon diodes are characterized by a knee in the voltage versus the current relationship when the voltage is applied in reverse or back direction. Up to the voltage breakdown, there is very little current, then at the breakdown the current increases rapidly with very little increase in the reverse voltage. In this region the equivalent circuit for the diode would be a battery in series with a low resistance. A simple diode voltage and its equivalent circuit are shown in Figure 1.

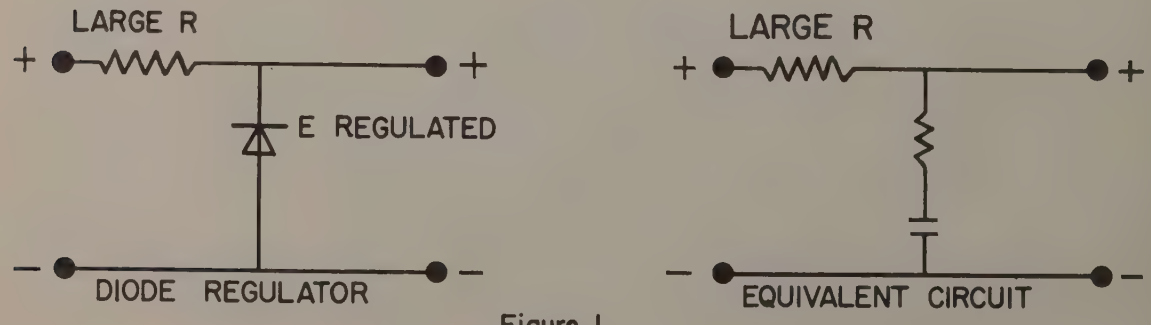


Figure 1

The breakdown voltage of the diode can be varied by changing the impurities of the silicon used in making the T-N junction. It has been found that the percentage change in voltage with current is lowest for a diode having a breakdown of about 6 volts DC. This means that the apparent internal resistance of the equivalent battery will be lowest for junctions of about that voltage. It has also been found that the temperature coefficient of the zener voltage varies with the breakdown voltage. The temperature coefficient is positive for diodes having a zener voltage about 5.5 volts and negative for those below. It has also been determined that the temperature coefficient and apparent internal resistance do vary with the diode reverse current so that a diode must operate over a narrow current region, if it is to be a high performance regulator.

The 117 volt supply is rectified and filtered and applied to a pair of diodes acting as a preregulator. The resistors and the capacitors in the DC filter have been chosen to reduce the ripple to a low level. The preregulator reduces voltage fluctuations by a factor of about 15 to 1, depending on the internal resistance of the diodes. Thus, a 15% line voltage variation is reduced to a 1% variation at this point. The final regulator diode reduces the voltage fluctuation still further by a factor of about 20 to 1. The regulating resistor for this diode is chosen so that the diode will operate at about 7 milliamps back current which was the value found to give the optimum of operation of low dynamic resistance and reliable temperature coefficients. The diodes can operate at reverse currents of twice this value without exceeding their dissipation rating. The small capacitor across the final diode is to remove very small voltage fluctuations at radio frequencies in the diode. Although we include the small capacitor across the final diode, there has been no evidence of radio frequencies in our measurements to date.

The process of selecting the diodes is very lengthy and involves a very exacting procedure which will not be discussed at this point. This procedure would prove of no value to the average customer as replacement parts, if needed for existing units in the field, will be selected for their particular duty in the circuit. It is sufficient to state that the zener diodes are checked for the following features:

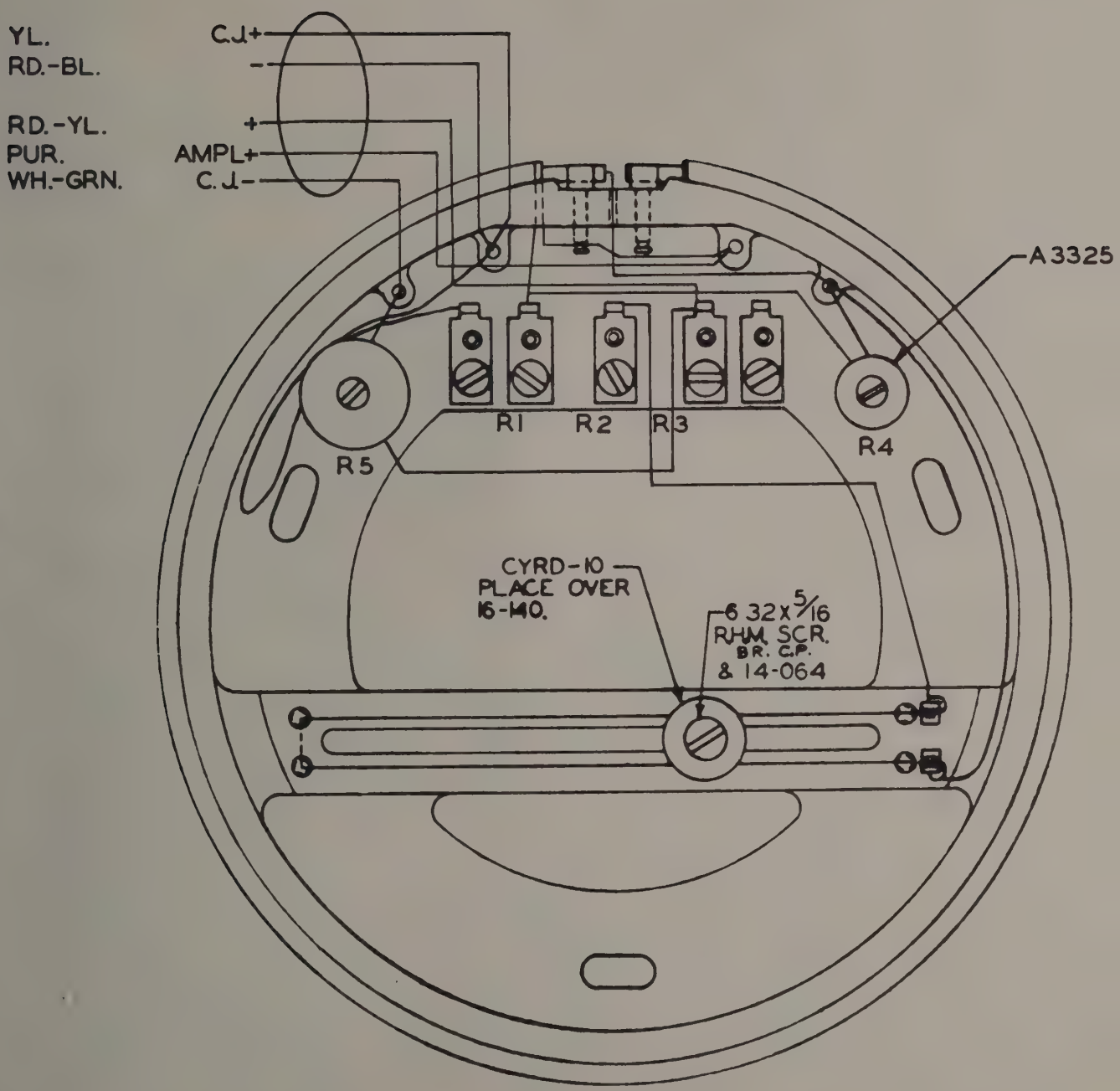
1) Zener voltage constancy
2) Dynamic internal resistance
3) The lowest resistance

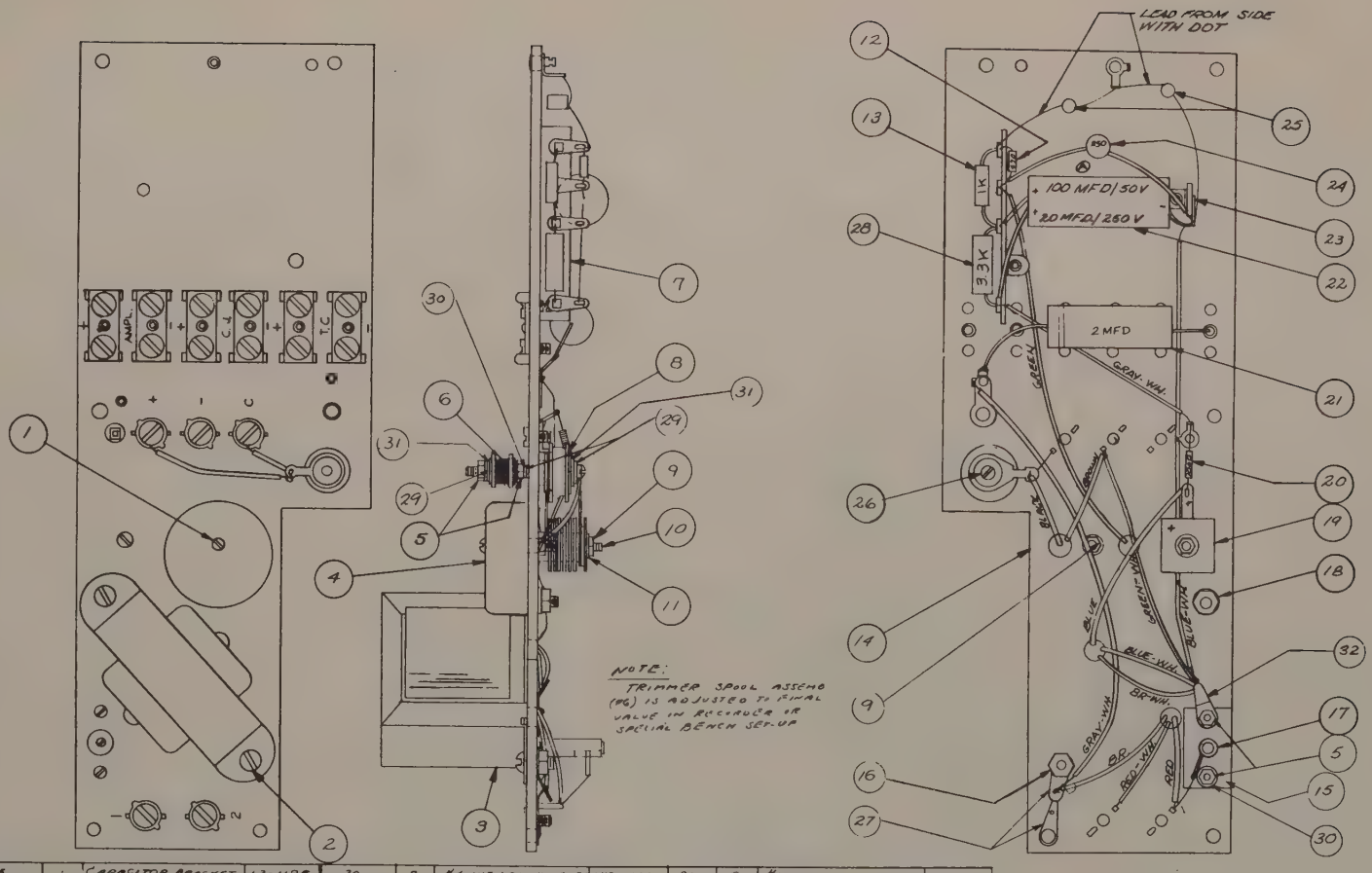
A steady current of 6 milliamperes is fed to the potentiometer measuring circuit. The potentiometer resistors are chosen so that a potentiometer voltage of 1.019 volts exists across the 1019 ohm potentiometer spool. The diode temperature compensation is based on the 6 milliamp load current and the voltage dropping resistors are chosen on the same basis. To allow a final adjustment for variations in potentiometer resistors and in the compensating and dropping resistors the manganin portion of the dropping resistance is split into two parts. The major portion is wound to within 20 ohms of the calculated total value and is aged along with the copper resistor which is wound to within 2% of its calculated value. When the reference voltage is installed in the recorder along with its potentiometer circuit, a pair of terminals is provided for the final dropping resistor. With the instru-

ment powered, a decade box is used in place of the dropping resistor and adjusted so that a potentiometer voltage is exactly 1.019 volts with the span adjustment at the midsetting. The final resistor is then wound to the value of the decade setting and installed at the terminals in reference supply. Final instrument calibration is made with the span adjustment. In the field the instrument calibration can be checked with a 330 potentiometer. It should not be necessary to check the reference source oftener than once each 6 months, or whenever calibration accuracy is questioned. The average diode shift over a period of 6 months is 0.02% with the average maximum shift of 0.04% and the highest maximum shift is 0.05%.

There are sufficient circuit differences in the instrument for use with the reference voltage to require different wiring between the recorder, slidewire and the reference supply. Please refer to the circuit drawings in this pamphlet.

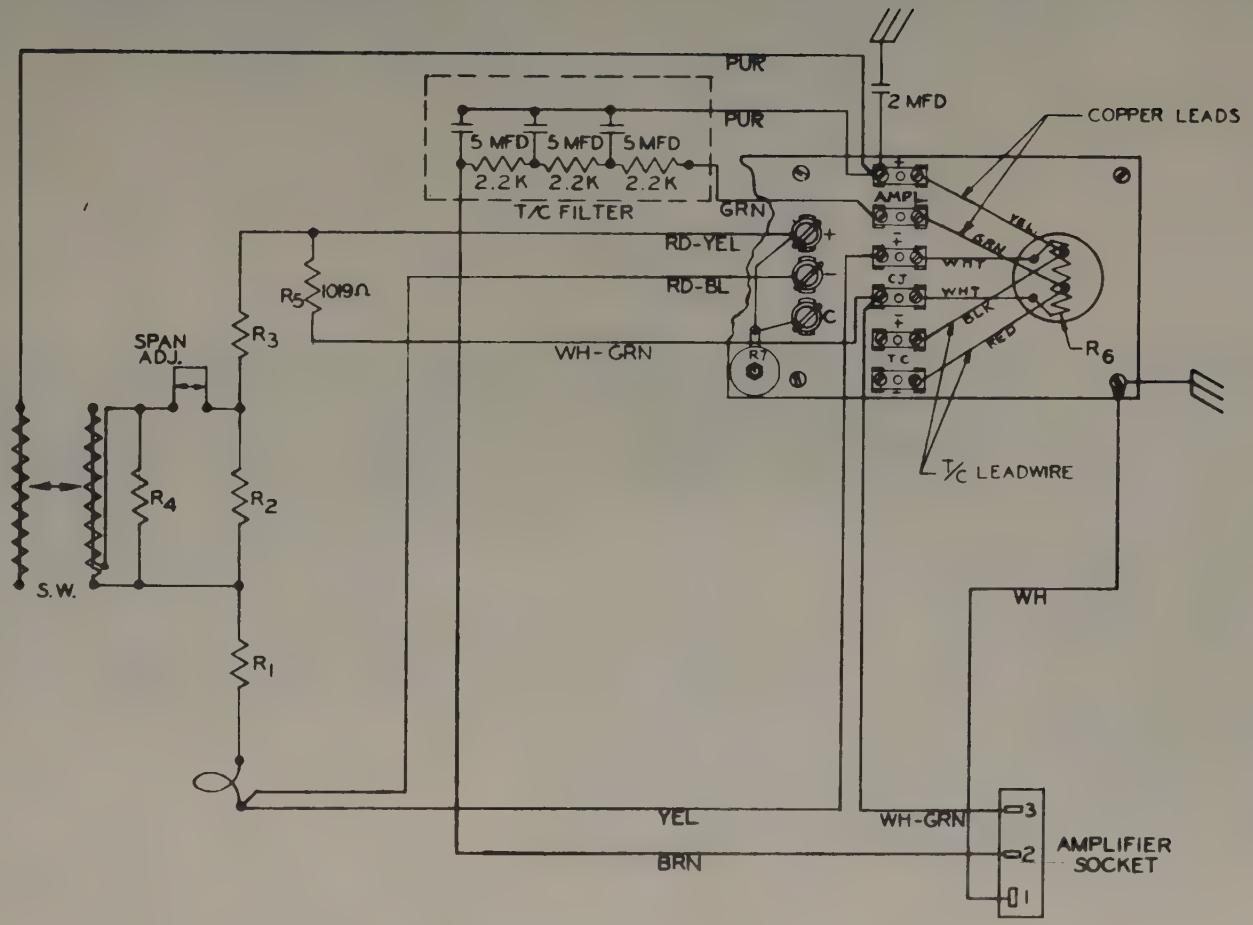
CONSTANT VOLTAGE SOURCE
SLIDEWIRE ASSEMBLY



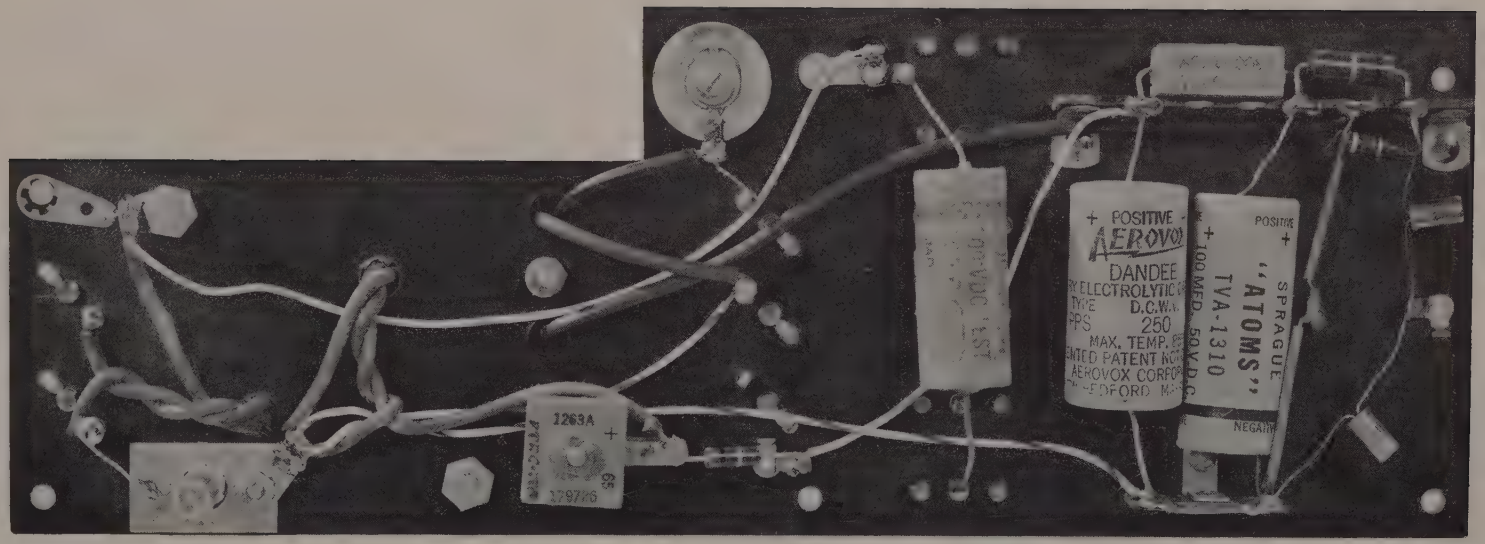


15	1	CAPACITOR BRACKET	13-1186	30	2	#4 INT LOCKWASHER	CYRD 144	31	2	#4 MICARTA SPACER	CYRD 3M
14	1	REF. VOLTAGE PANEL	33-174	29	3	#4 FLAT WASHER	CYRD 166	32	1	#4 SOLDER LUG	FYRE 23
13	1	RESISTOR 1K, 1W	CYZR1047	28	1	RESISTOR 33K 3W	40-118				
12	1	RESISTOR 470Ω ½W	CYZR1032	27	2	SOLDER LUG	FYRE 29				
11	2	#6 INTER. LOCKWASHER UP	CYRD 31	26	1	#8-40X1-3/8 FIL HDSC	BYRF 647				
10	1	#6-32X1" RHM S ST SLA	BYRF 416	25	2	ZENER DIODE	31-021				
9	2	#6-32X5/16 HEX NUT ST. CA	DYRF 102-1	24	1	CAP. 250MMF 3KV	39-076				
8	1	SPOOL ASSEMBLIES	A 3326	23	1	TERMINAL STRIP	34-306				
7	1	TERMINAL STRIP	34-323	22	1	DUAL ELECT. CAP 100 MFD/50V, 20 MFD/250V	39-127	(A)			
6	1	SPOOL ASSEMBLY	A3325	21	1	CAPACITOR 2 MFD 250V	39-077				
5	4	#4-40X1/4 HEX NUT SP CD	DYRF 3	20	1	RESISTOR 1000Ω 1W	CYZR1022	(B)			
4	1	POTTED SPOOL & DIODE ASSY	A3659	19	1	RECTIFIER	37-012				
3	1	115-115V TRANSFORMER	30-089-1	18	1	#8 INTER. LOCKWASHER	CYRD 38				
2	2	8-32X1/4 RH.M.S. BR CA	BYRF 89	17	1	TUBULAR TRIMMER	39 111				
1	1	4-40X1" RHM.S. BRCD	BYRF 586	16	2	#8-32X5/32 HEX. NUT	DYRF 19				
PART	QUAN	DESCRIPTION	PART NO.	PART	QUAN	DESCRIPTION	PART NO.				

CONSTANT VOLTAGE SOURCE INTERNAL WIRING DIAGRAM AND PARTS LIST.



POTENTIOMETER MEASURING CIRCUIT USING THE CONSTANT VOLTAGE SOURCE



CONSTANT VOLTAGE INSTALLATION

STANDARD CELL STANDARDIZATION INSTRUCTIONS

Manual standardization is furnished on all models without a constant voltage source. To standardize, push the standardizing knob and hold in until the pen has reached a balance and is at rest. Then release.

Standardization should be initiated when:

1) Installing a new battery.

2) Replacing the standard cell.

3) Long periods of shutdown have been experienced.

4) Accuracy is questioned.

The constant voltage source installations do not require standardization.

INSTALLING BATTERY

Place No. 6 dry cell (1-1/2 volts) in battery holder. Connect battery leads to + and - on the battery terminal strip. (Holder is located to the rear and left in the instrument). Terminal strip is designed to prevent the reversal of polarity.

CARE OF STANDARD CELL WHEN INSTRUMENT IS NOT IN USE TO PREVENT PERMANENT DAMAGE

1) Remove the standard cell from the instrument when temperatures are below 32°F. or higher than 140°F.

2) Store standard cell in moderate temperatures.

REMOVAL OF STANDARD CELL

1) Loosen TC and SC holding screws on terminal panel.

2) Remove TC leads.

3) Remove four mounting screws on TC and SC terminal mounting panel.

4) Use caution when removing panel mount; the standard cell is not protected.

5) Unsolder leads of SC.

6) When cell is removed, + and - leads should be properly insulated to prevent shorting.

7) Unscrew the two hex nuts holding standard cell bracket.

8) Caution should be used when removing the standard cell. Place the cell in a soft cloth and store.

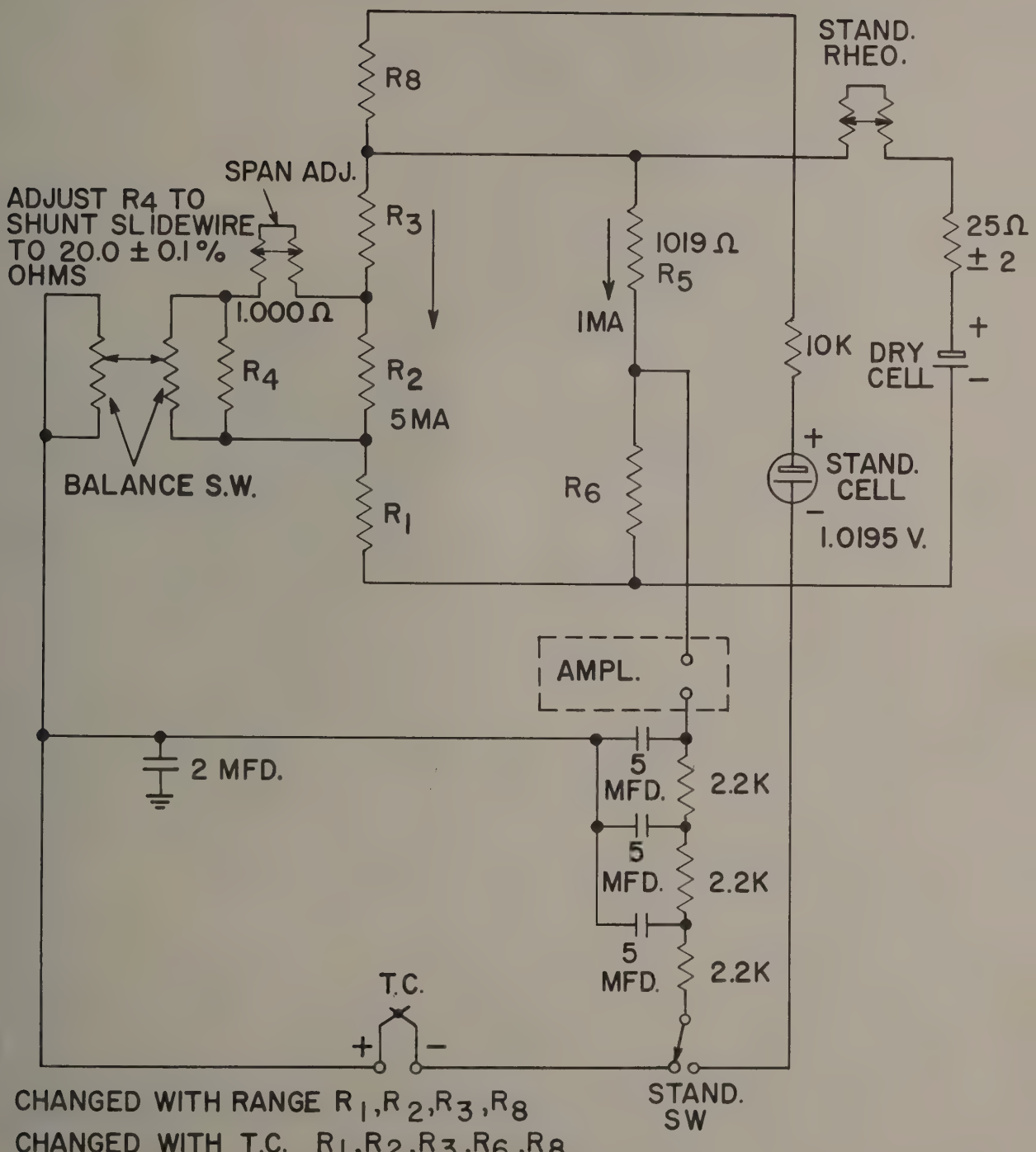
THE NO. 6 DRY CELL

The No. 6 dry cell is used as the source of current for normal operation of the recorder. It is calibrated against the standard cell so that it produces a known voltage and this is used in the measuring circuit of the unit.

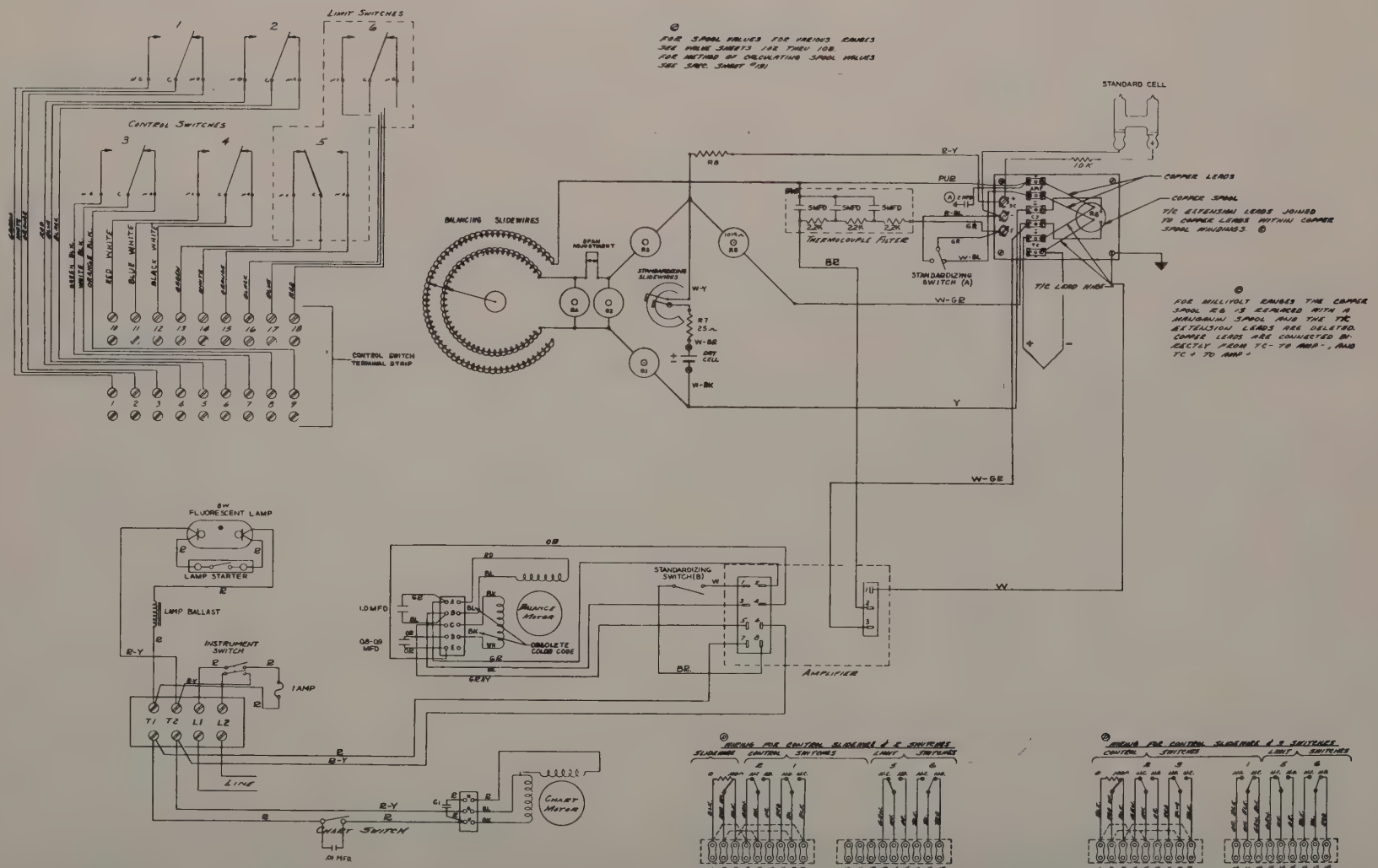
The amount of current drawn from it is very small and because of this the cell probably goes dead from chemical deterioration rather than electrical load.

On the right side of the chassis inside the cover is an indicator showing the condition of the cell. Normally the indication will be between the "new battery" index and the "replace" index. When the indicator reaches the "replace cell" area, the old No. 6 cell has to be removed and replaced with a new one. The cell is located in a bracket at the top rear of the instrument case. Loosen the two terminal lugs on the cell and remove the cell. Slip the new cell in place and tighten the two lugs.

POTENTIOMETER MEASURING CIRCUIT (WITH MANUAL STANDARDIZATION)



WIRING ASSEMBLY DIAGRAM



INTERNAL WIRING FOR MANUAL STANDARDIZATION

SUGGESTED REPLACEMENT PARTS

It is suggested that the following spare parts be carried by the user to insure against possible emergencies and accidental damage. These are listed in the order of probable relative need.

Component	Quantity	Part No.
Electronic Tube 12AX7	1	EYZP 70-10
Electronic Tube 5763	1	31-015
Electronic Tube 6X4	1	31-017
Glass Pen	1	48-005
Fuse 1/2 amp.)		
Fuse 1 amp.)	Purchase Locally	
Battery #6 Dry Cell)		

Note: We recommend the purchase of 12AX7, 6X4 and 5763 tubes from the Wheelco Instruments Division, Barber-Colman Company, to insure instrument functioning as designed.

The complete tool kit is listed as A 3566.

Below are listed tools and accesories that should be included as standard equipment on all potentiometer recorder-controllers:

A 1582	Wire pen cleaner
A 3464	Long dual bristol wrench with #6 and #8 keys
13-968	Surface mounting brackets
13-1034	Flush mounting brackets
13-1072	Open end wrench
13-1071	Open end wrench
13-1087	Limit switch adjusting wrench on models equipped with limit switch
13-1077	Limit switch adjusting wrench on models equipped with limit switch
50-072	Motor oil and plastic container
50-088	Lubricating oil and can (Ucon Oil) and plastic container

MATERIAL WARRANTY: All equipment except tubes, photocells, and thermocouples, which within one year from date of shipment is found to have been originally defective, will be repaired (replaced if necessary) free of charge, if returned immediately, prepaid to the factory at Rockford, Illinois. The seller shall not be liable to the purchaser, or to any other person, firm or corporation for any direct, indirect or consequential damages or injury of any kind or character; that by acceptance of such equipment the purchaser shall accept and assume all liability for any and all damages or injuries that may result from the use or misuse of such equipment by the purchaser, or by any other person, firm or corporation; and that there shall be no other warranty whatever, expressed or implied, with respect to such equipment.

Warranty and Inspection Card — PLEASE FILL OUT AND RETURN

This equipment is guaranteed in accordance with the statement of warranty appearing on our quotation and acknowledgement forms. Upon receipt of this card properly filled out Warranty becomes effective. All Wheelco instruments are manufactured to the highest standards of quality and are carefully inspected before packing. Instruments which have been damaged or fail to operate upon installation, should be reported to the factory at once.

Wheelco Instruments Division
Barber-Colman Company

MODEL NO.

SERIAL NO.

CALIBRATION INSP.

FINAL INSPECTION

Date Received

Company

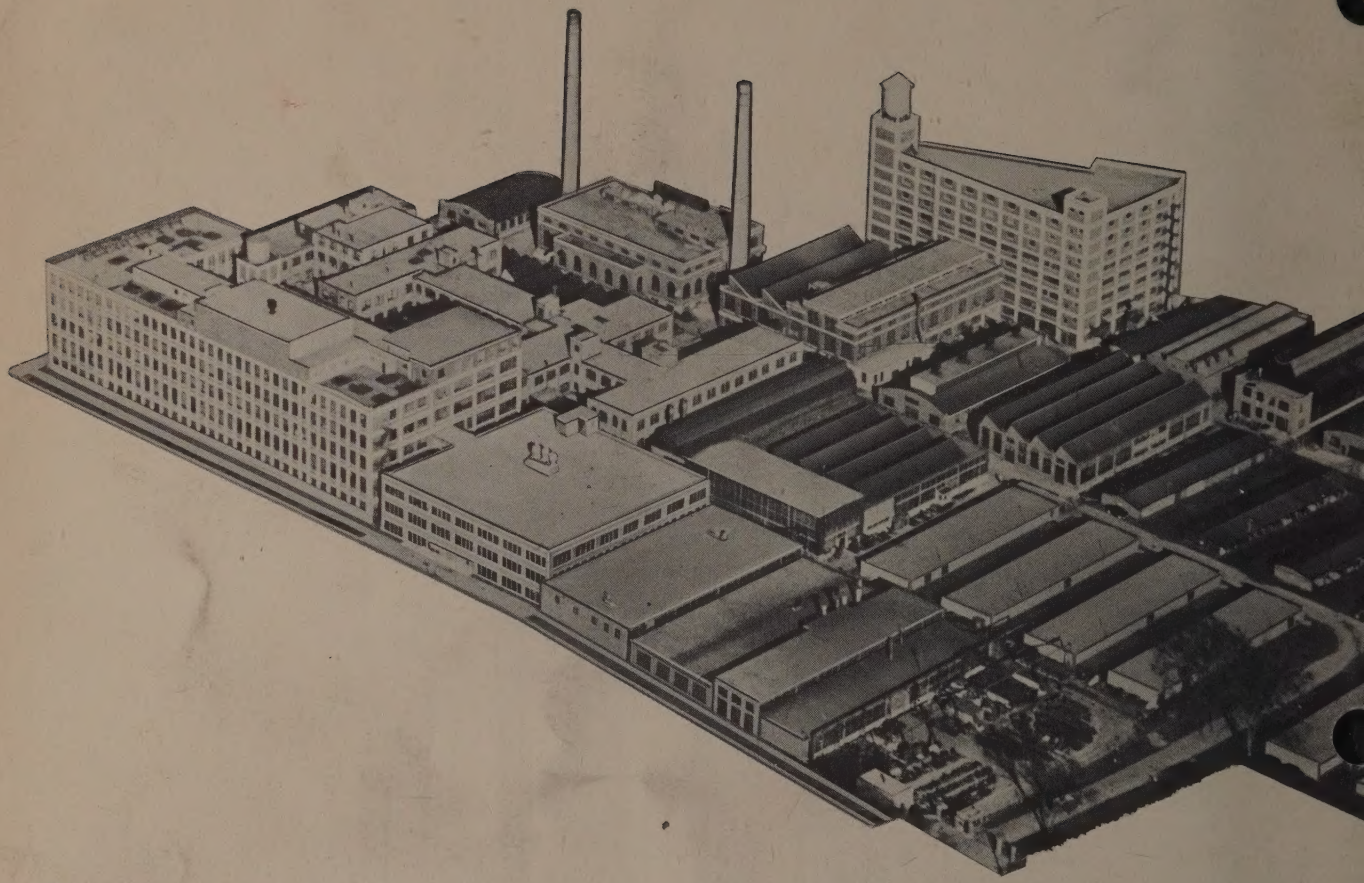
Street

City Zone State

By Title

COMMENTS

for your notes —



Wheelco Instruments

Manufactured by BARBER-COLMAN COMPANY

. . . for more than fifty years manufacturers of products far-reaching in their importance to industrial, commercial and individual users. Wheelco sales and service engineers are located throughout the United States and in many foreign countries.

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